

Single-spin transverse asymmetry
in charged hadron production
in $\sqrt{s}=200\text{GeV}$ p+p collisions
at PHENIX

Kensuke Okada (RIKEN)
for the PHENIX collaboration

PHENIX collaboration

About 400 people from all parts of the world.



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Physics Motivation at PHENIX Run2

from A_N : quark transverse spin issues in the proton

Fragmentation function of polarized quark (Collins-Heppelmann)

Initial parton intrinsic transverse momentum effects (Sivers)

Twist-three correlations (Qiu-Sterman)

from cross section : Judgment of NLO pQCD calculations

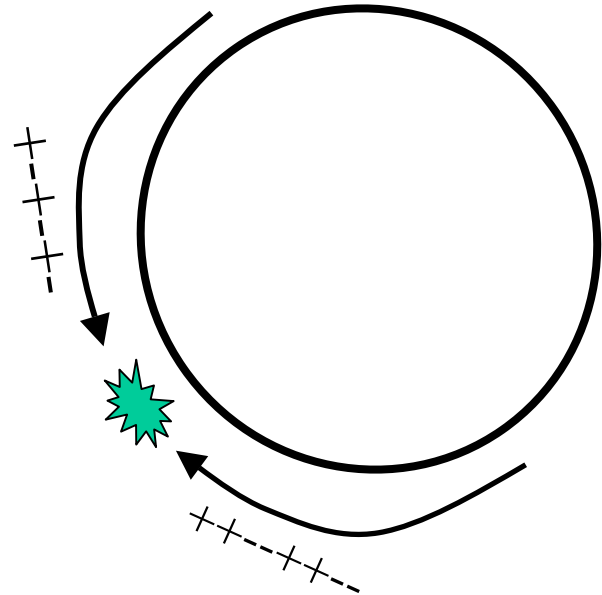
PHENIX Run2 (2001-2002)

The first data for the polarized p+p collision

Transverse polarization : $\langle \text{blue beam} \rangle = 14\%$
 $\langle \text{yellow beam} \rangle = 17\%$
max=25% was recorded

Total luminosity : 0.15 pb^{-1} (Jan 8 ~ Jan 22)

Polarization changed alternately
to reduce time dependence.



PHENIX Central Arm Detectors

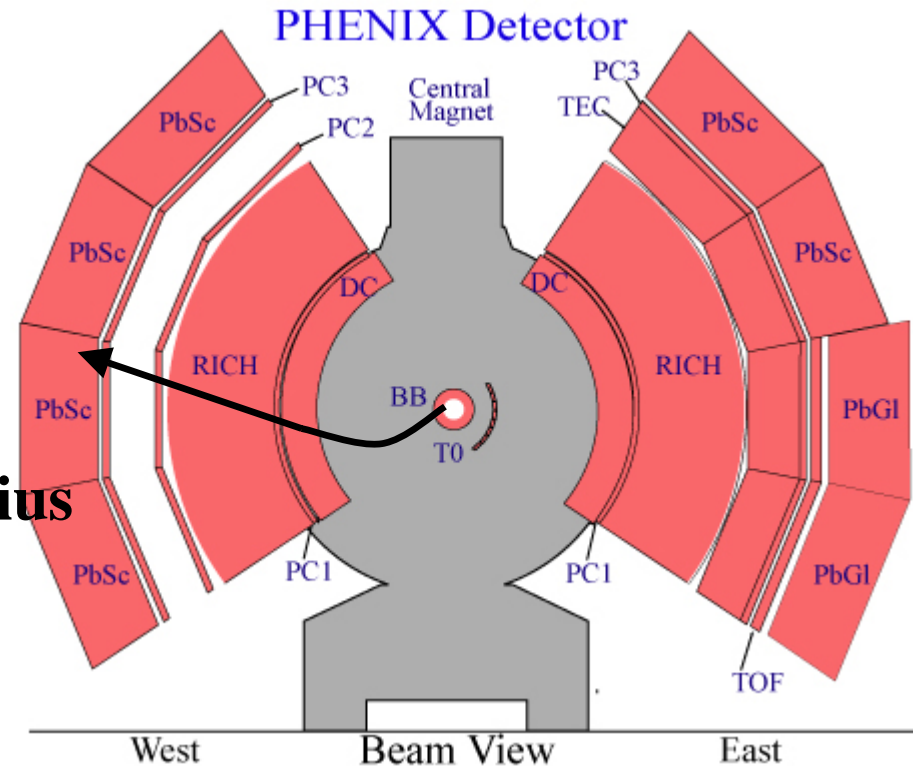
PHENIX central arm detectors

2 arms (west, east)

$|\eta| < 0.35$, $\phi = 180$ degree

**Magnetic field exists inside DC radius
($\Delta\phi = 90$ mrad for $1 \text{ GeV}/c$ particle)**

**The tracks were matched to
PAD chamber (PC) to remove
ghost tracks.**



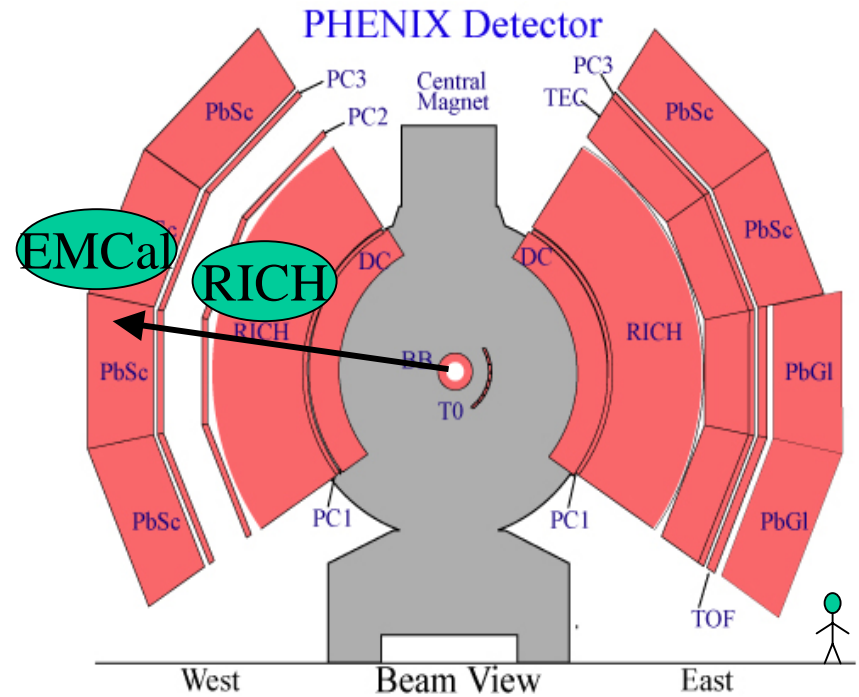
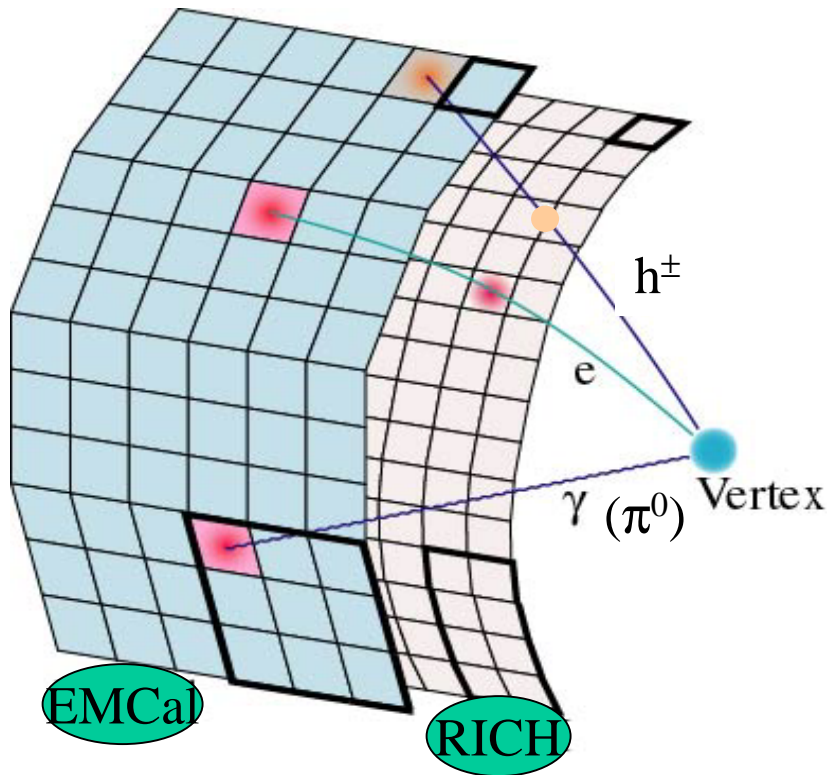
Event Trigger

◆ minimum-bias trigger : prescaled factor 10 to 80

◆ Electromagnetic Calorimeter trigger

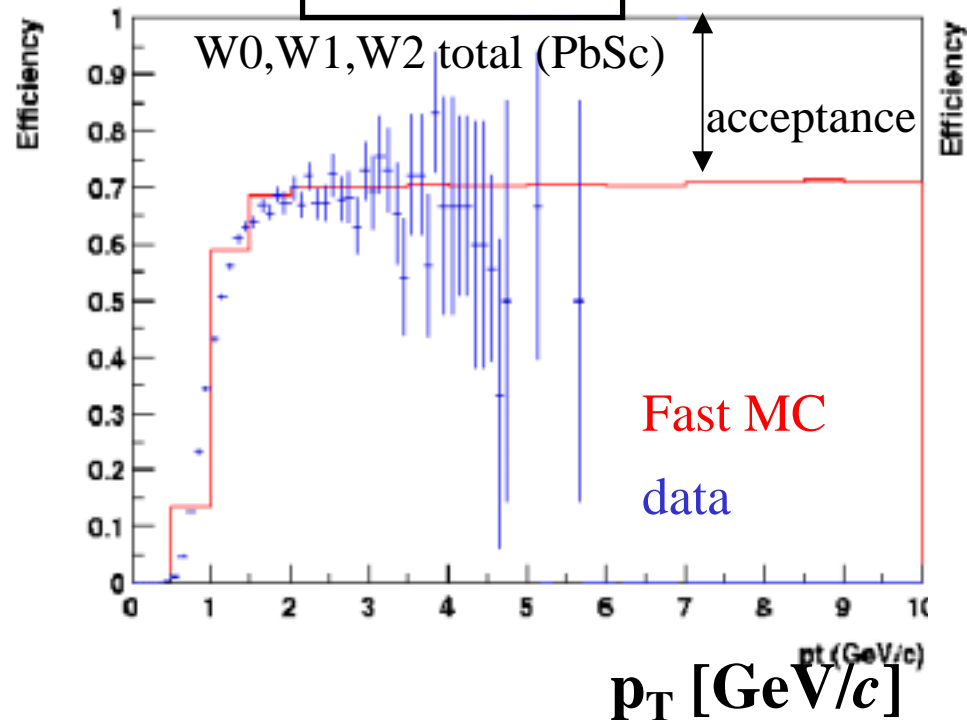
(a part of EMCal-RICH level-1 trigger)

: charged hadron trigger via interactions in EMCal

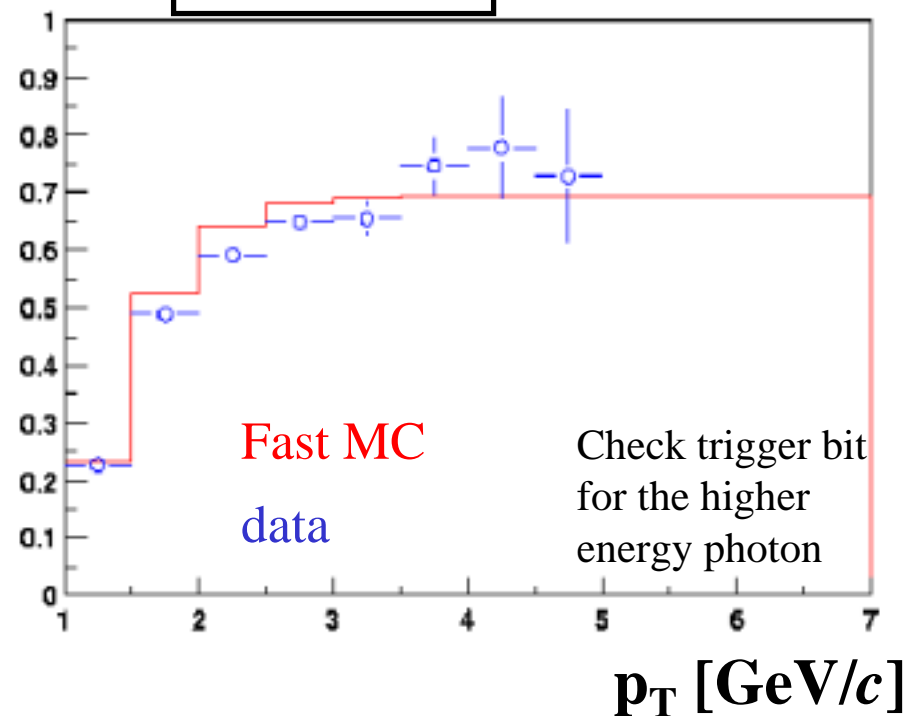


In the case of Photons

Photon



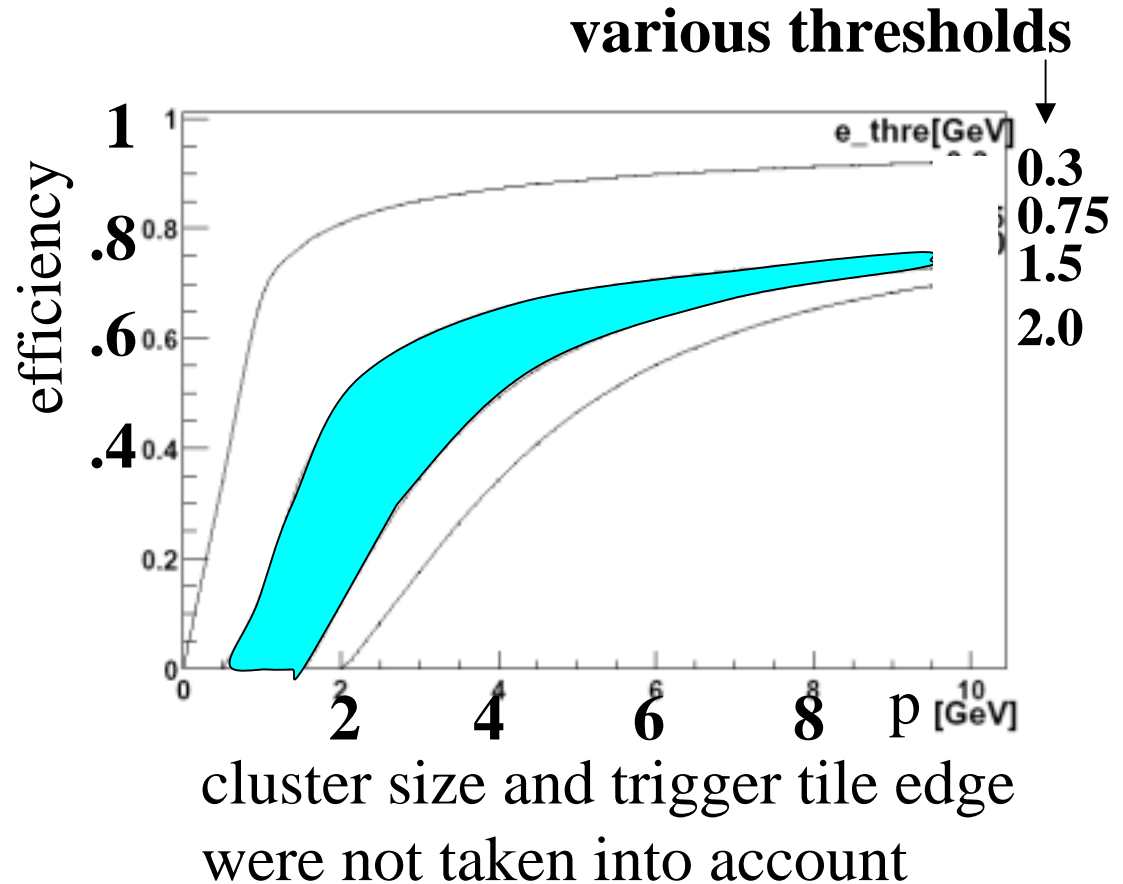
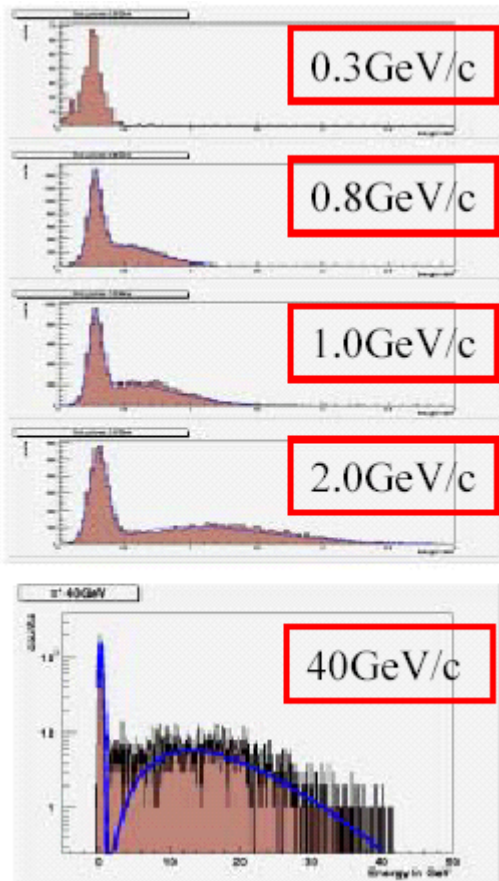
π^0



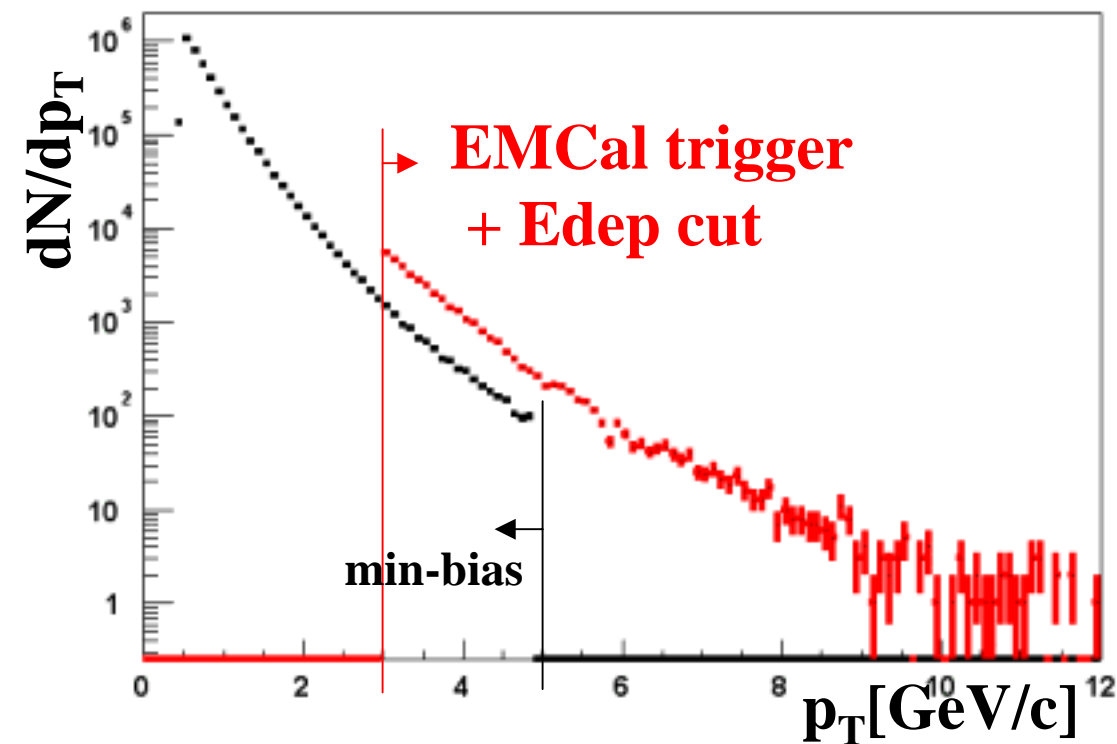
Its performance was understood very well.

Trigger Efficiency for Hadrons

PbSc π response from
the test beam data

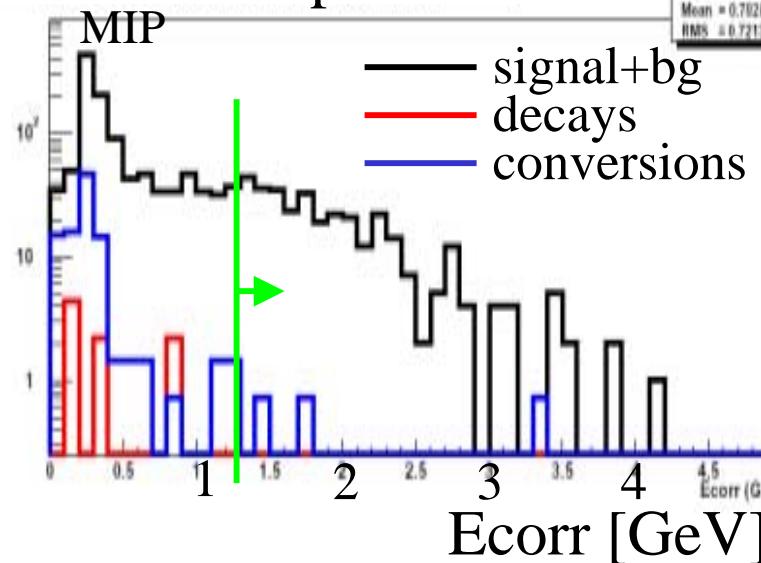


EMCal Energy Deposit of Charged Hadrons

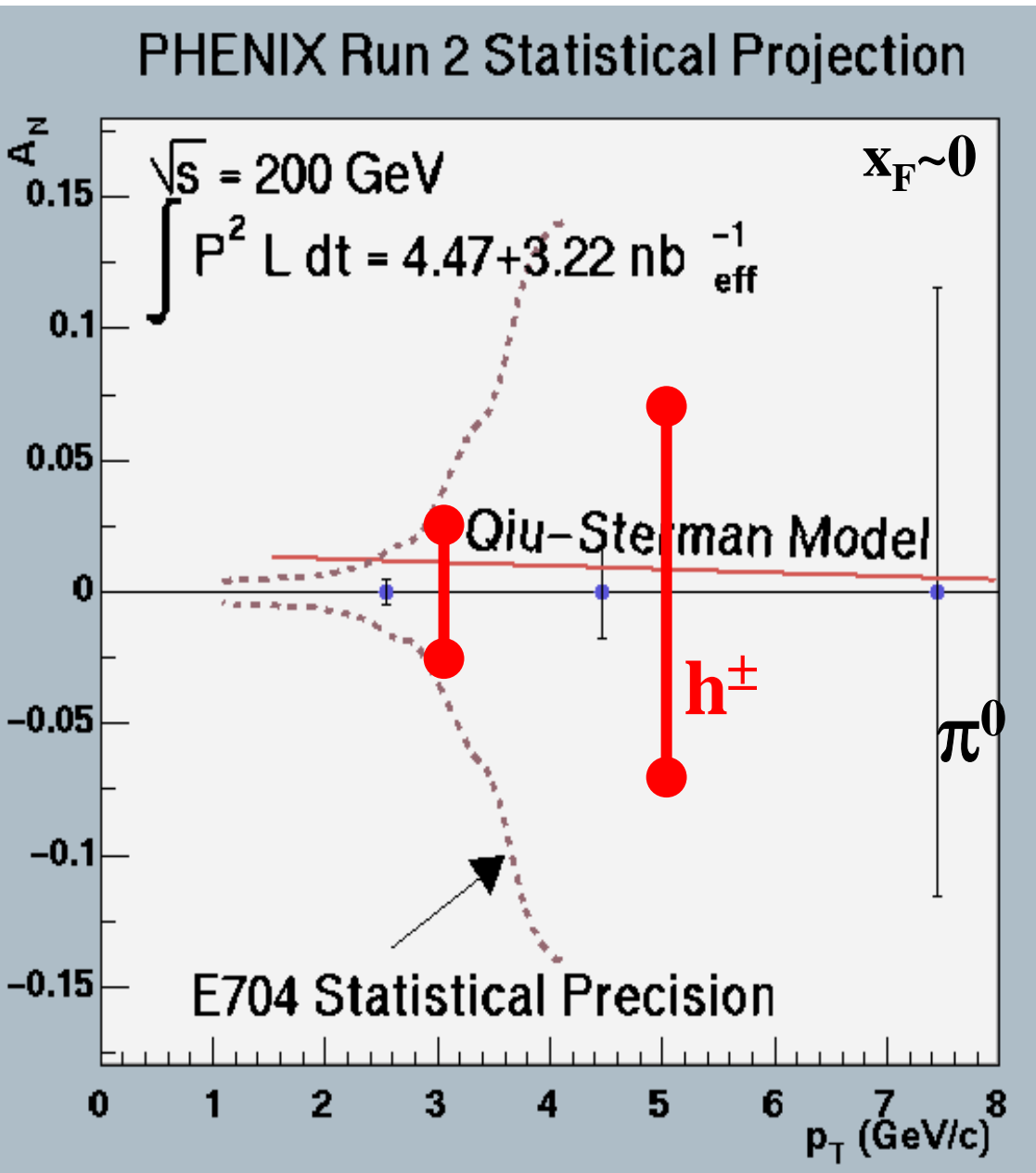


**High p_T region is covered
by EMCal trigger events**

**Edep cut rejects
backgrounds.**
3-4 GeV/c particles



Error Expectation on A_N



only statistical error
 $1/P\sqrt{(N)}$
 (polarization: $P = 15\%$)

The difference to π^0 is
 due to the trigger efficiency.

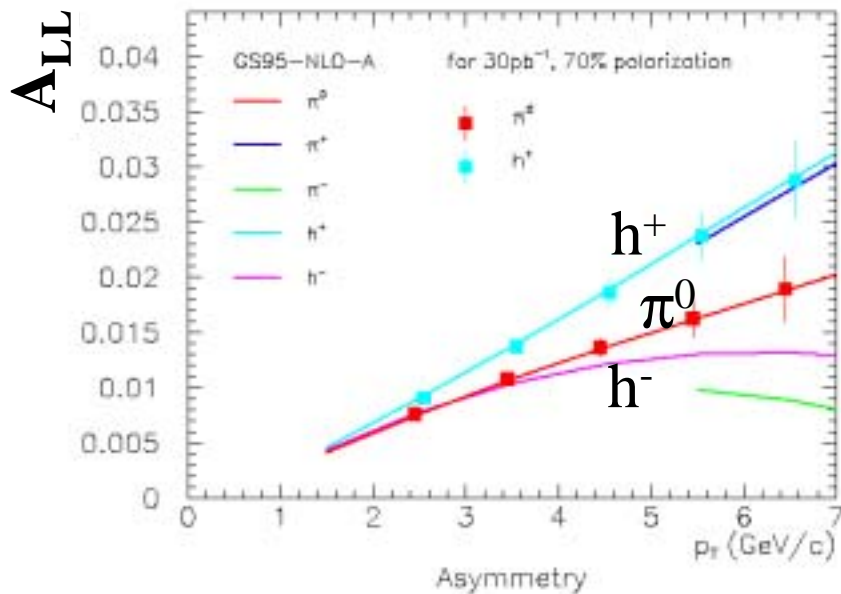
A_{LL} in RUN3 and RUN4

A_{LL} : gluon polarization

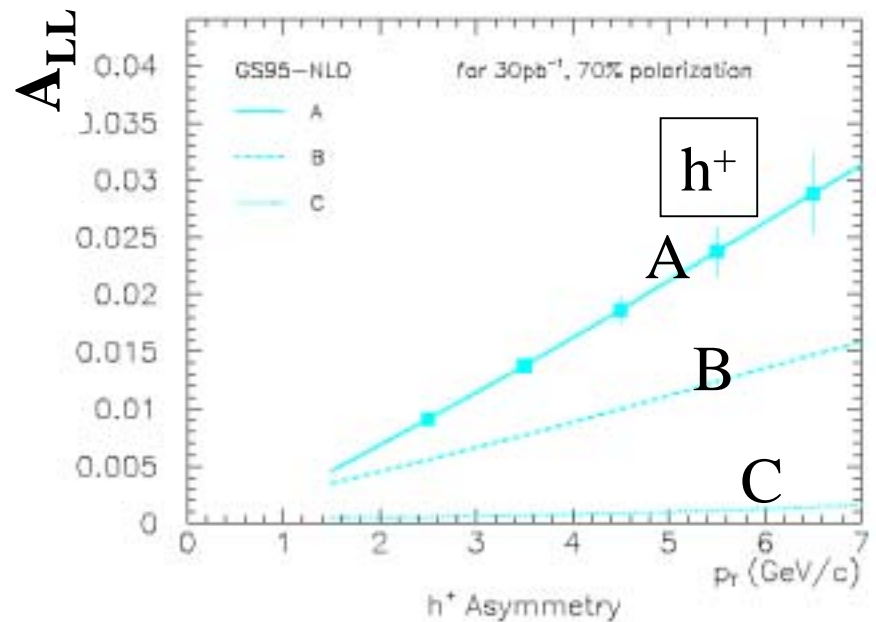
RUN3 : 3pb^{-1} , 50% polarization

RUN4 : 30pb^{-1} , 70% polarization

Estimate for RUN4



for different charges



for different ΔG

Summary

- ◆ We understand our detectors. The combination of minimum-bias events and EMCal trigger events provide us pure hadron sample.
- ◆ Cross sections of $\sigma_{h^+}, \sigma_{h^-}$ will be obtained up to 8GeV/c.
- ◆ Statistics of the charged hadron at PHENIX-run2 was shown. Based on it, statistical error on A_N was estimated.



- ◆ At PHENIX in Run 03/04, an A_{LL} measurement with charged hadrons will have sensitivity to ΔG .